



OSWER Innovations Pilot

Industrial Phosphate Sludge Waste as a Raw Material for Iron Phosphate Glass

The Office of Solid Waste and Emergency Response (OSWER) initiated a series of innovative pilots to test new ideas and strategies for environmental and public health protection to make OSWER programs more efficient, effective, and user-friendly. A small amount of money is set aside to fund creative proposals. The creative projects test approaches to waste minimization, energy recovery, recycling, land revitalization, and homeland security that may be replicated across various sectors, industries, communities, and regions. We hope these pilots will pave the way for programmatic and policy recommendations by demonstrating the environmental and economic benefits of creative, innovative approaches to the difficult environmental challenges we face today.

BACKGROUND

Every year, the fabricated metal products industry generates phosphate sludge waste on the order of tens of millions of pounds. Automobile, heavy equipment, appliance, fastener, and other fabricated metal manufacturers generate waste sludge as a by-product of the phosphate chemical conversion coating process that is used to improve paint adhesion and corrosion resistance of finished products. The majority of these operations are related to the treatment of ferrous substrates, and the resulting waste is non-hazardous under U.S. EPA regulations.

No beneficial reuse market for phosphate waste sludge currently exists. However, recent collaborations between the Illinois Waste Management and Research Center (WMRC), the University of Missouri-Rolla (UMR), and Mo-Sci Corporation have yielded a potential commercial application for this waste. Preliminary work indicates that phosphating wastes are an ideal raw material for producing iron phosphate glass. Research also shows that iron phosphate glass offers great potential as low energy alternatives to commercial silica-based glass fibers.

PILOT APPROACH

U.S. EPA Region 5, in partnership with WMRC, Mo-Sci, and the University of Illinois at Urbana-Champaign will investigate the feasibility of using non-hazardous

industrial phosphate sludge waste as a raw material for iron phosphate glass. WMRC will work with EPA, the Illinois Environmental Protection Agency (IEPA), and the Missouri Department of Natural Resources (MDNR) to identify regulations that affect the handling and transportation of non-hazardous industrial phosphate sludge wastes and explore qualitative and quantitative issues relating to waste handling at each facility on a case-by-case basis.

WMRC plans to obtain small-volume sludge samples from at least ten industrial sites within Illinois and analyze them for critical iron phosphate glass components, RCRA metals, and other elements that may affect air emissions. WMRC will perform an extended study with at least one facility to explore the variability of sludge wastes. Mo-Sci Corporation will process approximately five sludge samples into glass. This step will be important from both regulatory and technical perspectives because it will reinforce the preliminary findings that the sludge is an ideal raw material in the production of iron phosphate glass. Finally, WMRC will estimate the quantity of sludge waste that is readily available for recycling and gauge the potential environmental and economic benefits of recycling these wastes. Promising applications for iron phosphate glasses include glass fibers for polymer reinforced composites, glass fiber reinforced concrete, and nuclear waste vitrification materials.

INNOVATION

This project will be the first study of its kind to evaluate the regulatory and commercial feasibility of capturing the value of millions of pounds of industrial phosphate sludge waste. Without this project, it is unlikely that the beneficial reuse of industrial phosphate sludge would ever occur. A number of barriers and uncertainties prevent this material from being commercially utilized. These barriers and uncertainties are either directly or indirectly related to environmental regulations.

BENEFITS

The benefits of reusing industrial phosphating sludge extend from energy savings and reduced waste disposal to providing a reduced cost, high quality raw material for an important glass technology. Iron phosphate glass fibers can be produced at a savings of over 6,500,000 Btu per ton, compared with commercial silica-based glass fibers. Increased usage of iron phosphate glass would also result in reduced worker exposure to hazardous silica dust. Each year, millions of pounds of solid waste could be diverted for a beneficial reuse. A potentially low-cost raw material could be made available for nuclear waste vitrification materials, alkaline resistant glass fibers in structural cement, and reinforced polymer composites (i.e., fiberglass). Additionally, companies that generate the sludge waste could realize significant cost savings due to reduced waste disposal.

CONTACTS

Jason Swift, EPA Region 5, 312-886-0754

For additional information, visit the EPA OSWER Innovations web site at: www.epa.gov/oswer/IWG.htm.